

Working Conditions

Stationary engineers generally have steady, year-round employment. The average workweek is 40 hours. In facilities that operate around the clock, an engineer usually works one of three daily 8-hour shifts on a rotating basis. Weekend and holiday work often is required.

Engine rooms, power plants, and boiler rooms usually are clean and well lighted. Even under the most favorable conditions, however, some stationary engineers are exposed to high temperatures, dust, dirt, and high noise levels from the equipment. General maintenance duties may also require contact with oil, grease, or smoke. Workers spend much of their time on their feet. They may also have to crawl inside boilers and work in crouching or kneeling positions to inspect, clean, or repair equipment.

Stationary engineers work around potentially hazardous machinery such as boilers and electrical equipment. They must follow procedures to guard against burns, electric shock, and exposure to hazardous materials such as asbestos or certain chemicals.

Employment

Stationary engineers held about 31,000 jobs in 1998. They worked in a variety of places, including factories, hospitals, hotels, office and apartment buildings, schools, and shopping malls. Some are employed as contractors to a building or plant.

Stationary engineers work throughout the country, generally in the more heavily populated areas where large industrial and commercial establishments are located.

Training, Other Qualifications, and Advancement

Stationary engineers usually acquire their skills through a formal apprenticeship program or informal on-the-job training supplemented by courses at a trade or technical school. In addition, valuable experience can be obtained in the Navy or the Merchant Marine because marine-engineering plants are similar to many stationary power and heating plants. Most employers prefer to hire persons with at least a high school diploma or its equivalent due to the increasing complexity of the equipment engineers work with. Many stationary engineers have some college education. Mechanical aptitude, manual dexterity, and good physical condition also are important.

The International Union of Operating Engineers sponsors apprenticeship programs and is the principal union for stationary engineers. In selecting apprentices, most local labor-management apprenticeship committees prefer applicants with education or training in mathematics, computers, mechanical drawing, machine-shop practice, physics, and chemistry.

An apprenticeship usually lasts 4 years and includes 8,000 hours of on-the-job training. In addition, apprentices receive 600 hours of classroom instruction in subjects such as boiler design and operation, elementary physics, pneumatics, refrigeration, air conditioning, electricity, and electronics.

Those who acquire their skills on the job usually start as boiler tenders or helpers to experienced stationary engineers. This practical experience may be supplemented by postsecondary vocational training in computerized controls and instrumentation. However, becoming a stationary engineer without completing a formal apprenticeship program usually requires many years of work experience.

Most large and some small employers encourage and pay for skill-improvement training for their employees. Training is almost always provided when new equipment is introduced or when regulations concerning some aspect of their duties change.

Most States and cities have licensing requirements for stationary engineers. Applicants usually must be at least 18 years of age, reside for a specified period in the State or locality, meet experience requirements, and pass a written examination. A stationary engineer who moves from one State or city to another may have to pass an examination for a new license due to regional differences in licensing requirements.

There are several classes of stationary engineer licenses. Each class specifies the type and size of equipment the engineer can operate without supervision. A licensed first-class stationary engineer is qualified to run a large facility, supervise others, and operate equipment of all types

and capacities. An applicant for this license may be required to have a high school education, apprenticeship or on-the-job training, and several years of experience. Licenses below first class limit the types or capacities of equipment the engineer may operate without supervision.

Stationary engineers advance by being placed in charge of larger, more powerful, or more varied equipment. Generally, engineers advance to these jobs as they obtain higher class licenses. Some stationary engineers advance to boiler inspectors, chief plant engineers, building and plant superintendents, or building managers. A few obtain jobs as examining engineers or technical instructors.

Job Outlook

Persons wishing to become stationary engineers may face competition for job openings. Employment opportunities will be best for those with apprenticeship training or vocational school courses covering systems operation using computerized controls and instrumentation.

Employment of stationary engineers is expected to decline through the year 2008. Continuing commercial and industrial development will increase the amount of equipment to be operated and maintained. However, automated systems and computerized controls are making newly-installed equipment more efficient, thus reducing the number of jobs needed for their operation. Some job openings will arise from the need to replace experienced workers who transfer to other occupations or leave the labor force. However, turnover in this occupation is low, partly due to its high wages. Consequently, relatively few replacement openings are expected.

Earnings

Median annual earnings of stationary engineers were \$38,270 in 1998. The middle 50 percent earned between \$31,560 and \$46,390 a year. The lowest 10 percent earned less than \$24,910 and the highest 10 percent earned more than \$55,730 a year.

Related Occupations

Other workers who monitor and operate stationary machinery include nuclear reactor operators, power station operators, water and wastewater treatment plant operators, waterworks pump-station operators, chemical plant and system operators, and refinery operators. Often, workers who operate and maintain all of the equipment in a building or plant are called general maintenance mechanics.

Sources of Additional Information

Information about apprenticeships and vocational training or work opportunities is available from local offices of State employment services, locals of the International Union of Operating Engineers, vocational schools, and from State and local licensing agencies.

Specific questions about this occupation should be addressed to:

- ✦ International Union of Operating Engineers, 1125 17th St. NW, Washington, DC 20036. Internet: <http://www.iuoe.org>
- ✦ National Association of Power Engineers, Inc., 1 Springfield St., Chicopee, MA 01013. Internet: <http://www.powerengineers.com>
- ✦ Building Owners and Managers Institute International, 1521 Ritchie Hwy., Arnold, MD 21012. Internet: <http://www.bomi-edu.org>

Water and Wastewater Treatment Plant Operators

(O*NET 95002A)

Significant Points

- Employment is concentrated in local government and private water supply and sanitary services companies.
- Although completion of high school continues to be sufficient for most jobs, postsecondary training is increasingly an asset as new water pollution control standards make treatment plants more complex.

- In 49 States, operators must pass exams certifying that they are capable of overseeing various treatment processes.

Nature of the Work

Clean water is essential for good health, recreation, fish and wildlife, and industry. *Water treatment plant operators* treat water so that it is safe to drink. *Wastewater treatment plant operators* remove harmful pollutants from domestic and industrial wastewater so that it is safe to return to the environment.

Water is pumped from wells, rivers, and streams to water treatment plants where it is treated and distributed to customers. Wastewater travels through customers' sewer pipes to wastewater treatment plants where it is treated and returned to streams, rivers, and oceans, or reused for irrigation and landscaping. Operators in both types of plants control processes and equipment to remove or destroy harmful materials, chemical compounds, and microorganisms from the water. They also control pumps, valves, and other processing equipment to move the water or wastewater through the various treatment processes, and dispose of the removed waste materials.

Operators read, interpret, and adjust meters and gauges to make sure plant equipment and processes are working properly. They operate chemical-feeding devices, take samples of the water or wastewater, perform chemical and biological laboratory analyses, and adjust the amount of chemicals, such as chlorine, in the water. They use a variety of instruments to sample and measure water quality, and common hand and power tools to make repairs. Operators also make minor repairs to valves, pumps, and other equipment.

Water and wastewater treatment plant operators increasingly rely on computers to help monitor equipment, store sampling results, make process control decisions, schedule and record maintenance activities, and produce reports. When problems occur, operators may use their computers to determine the cause of the malfunction and its solution.

Occasionally operators must work under emergency conditions. A heavy rainstorm, for example, may cause large amounts of wastewater to flow into sewers, exceeding a plant's treatment capacity. Emergencies also can be caused by conditions inside a plant, such as chlorine gas leaks or oxygen deficiencies. To handle these conditions, operators are trained in emergency management response using special safety equipment and procedures to protect public health and the facility. During these periods, operators may work under extreme pressure to correct problems as quickly as possible. These periods may create dangerous working conditions and operators must be extremely cautious.

The specific duties of plant operators depend on the type and size of plant. In smaller plants, one operator may control all machinery, perform tests, keep records, handle complaints, and do repairs and maintenance. A few operators may handle both a water treatment and a wastewater treatment plant. In larger plants with many employees, operators may be more specialized and only monitor one process. The staff may also include chemists, engineers, laboratory technicians, mechanics, helpers, supervisors, and a superintendent.

Water pollution standards have become increasingly stringent since adoption of two major Federal environmental statutes: the Clean Water Act of 1972, which implemented a national system of regulation on the discharge of pollutants; and the Safe Drinking Water Act of 1974, which established standards for drinking water. Industrial facilities sending their wastes to municipal treatment plants must meet certain minimum standards to ensure the wastes have been adequately pretreated and will not damage municipal treatment facilities. Municipal water treatment plants also must meet stringent drinking water standards. The list of contaminants regulated by these statutes has grown over time. For example, the 1996 Safe Drinking Water Act Amendments include standards for the monitoring of cryptosporidium and giardia, two biological organisms that cause health problems. Operators must be familiar with the guidelines established by Federal regulations and how they affect their plant. In addition to Federal regulations, operators also must be aware of any guidelines imposed by the State or locality in which the plant operates.



Water and wastewater treatment plant operators increasingly rely on computers.

Working Conditions

Water and wastewater treatment plant operators work both indoors and outdoors and may be exposed to noise from machinery and unpleasant odors. Operators have to stoop, reach, and climb and sometimes get their clothes dirty. They must pay close attention to safety procedures for they may be confronted with hazardous conditions, such as slippery walkways, dangerous gases, and malfunctioning equipment. Plants operate 24 hours a day, 7 days a week; therefore, operators work one of three 8-hour shifts and weekends and holidays on a rotational basis. Whenever emergencies arise, operators may be required to work overtime.

Employment

Water and wastewater treatment plant operators held about 98,000 jobs in 1998. Most worked for local governments. Some worked for private water supply and sanitary services companies, which increasingly provide operation and management services to local governments on a contract basis. About half worked as water treatment plant operators and half worked as wastewater treatment plant operators.

Water and wastewater treatment plant operators are employed throughout the country, but most jobs are in larger towns and cities. Although nearly all work full time, those who work in small towns may only work part time at the treatment plant—the remainder of their time may be spent handling other municipal duties.

Training, Other Qualifications, and Advancement

A high school diploma commonly is required for water and wastewater treatment plant operator jobs. Operators need mechanical aptitude and should be competent in basic mathematics, chemistry, and biology. They must have the ability to apply data to formulas of treatment requirements, flow levels, and concentration levels. Some basic familiarity with computers also is necessary because of the trend toward computer-controlled equipment and more sophisticated instrumentation. Certain positions—particularly in larger cities and towns—are covered by civil service regulations. Applicants for these positions may be required to pass a written examination testing elementary mathematics skills, mechanical aptitude, and general intelligence.

Completion of an associate degree or 1-year certificate program in water quality and wastewater treatment technology increases an applicant's chances for employment and promotion because plants are becoming more complex. Offered throughout the country, these programs provide a good general knowledge of water and wastewater treatment processes as well as basic preparation for becoming an operator.

Trainees usually start as attendants or operators-in-training and learn their skills on the job under the direction of an experienced operator. They learn by observing and doing routine tasks such as recording

meter readings; taking samples of wastewater and sludge; and performing simple maintenance and repair work on pumps, electric motors, valves, and other plant equipment. Larger treatment plants generally combine this on-the-job training with formal classroom or self-paced study programs.

In 49 States, operators must pass an examination to certify that they are capable of overseeing wastewater treatment plant operations. A voluntary certification program is in effect in the remaining State. There are different levels of certification depending on the operator's experience and training. Higher certification levels qualify the operator for a wider variety of treatment processes. Certification requirements vary by State and by size of treatment plants. Although relocation may mean having to become certified in a new location, many States accept other States' certifications.

Presently a nationally mandated certification program for operators does not exist. However, the Safe Drinking Water Act Amendments of 1996 require that within 2 years the Environmental Protection Agency specify minimum standards for drinking water operator certification, and that States implement those standards within another 2 years.

Most State drinking water and water pollution control agencies offer training courses to improve operators' skills and knowledge. These courses cover principles of treatment processes and process control, laboratory procedures, maintenance, management skills, collection systems, safety, chlorination, sedimentation, biological treatment, sludge treatment and disposal, and flow measurements. Some operators take correspondence courses on subjects related to water and wastewater treatment, and some employers pay part of the tuition for related college courses in science or engineering.

As operators are promoted, they become responsible for more complex treatment processes. Some operators are promoted to plant supervisor or superintendent; others advance by transferring to a larger facility. Postsecondary training in water and wastewater treatment coupled with increasingly responsible experience as an operator may be sufficient to qualify for superintendent of a small plant, where a superintendent also serves as an operator. However, educational requirements are rising as larger, more complex treatment plants are built to meet new drinking water and water pollution control standards. With each promotion, the operator must have greater knowledge of Federal, State, and local regulations. Superintendents of large plants generally need an engineering or science degree.

A few operators get jobs with State drinking water or water pollution control agencies as technicians, who monitor and provide technical assistance to plants throughout the State. Vocational-technical school or community college training generally is preferred for technician jobs. Experienced operators may transfer to related jobs with industrial wastewater treatment plants, water or wastewater treatment equipment and chemical companies, engineering consulting firms, or vocational-technical schools.

Job Outlook

Employment of water and wastewater treatment plant operators is expected to grow as fast as the average for all occupations through the year

2008. Because the number of applicants in this field is normally low, job prospects will be good for qualified applicants.

The increasing population and growth of the economy are expected to increase demand for essential water and wastewater treatment services. As new plants are constructed to meet this demand, employment of water and wastewater treatment plant operators will increase. In addition, some job openings will occur as experienced operators transfer to other occupations or leave the labor force.

Local governments are the largest employers of water and wastewater treatment plant operators. However, industry deregulation has increased reliance on private firms specializing in the operation and management of water and wastewater treatment facilities. As a result, employment in privately owned facilities will grow much faster than the average. Increased pre-treatment activity by manufacturing firms will also create new job opportunities.

Earnings

Median annual earnings of water and liquid waste treatment plant and system operators were \$29,660 in 1998. The middle 50 percent earned between \$23,210 and \$36,680. The lowest 10 percent earned less than \$18,500 and the highest 10 percent earned more than \$44,710. Median annual earnings of water and liquid waste treatment plant and systems operators in 1997 were \$28,700 in local government, except education and hospitals.

In addition to their annual salaries, water and wastewater treatment plant operators usually receive benefits that include health and life insurance, a retirement plan, and educational reimbursement for job-related courses.

Related Occupations

Other workers whose main activity consists of operating a system of machinery to process or produce materials include boiler operators, gas-compressor operators, power plant operators, power reactor operators, stationary engineers, turbine operators, chemical plant and system operators, and petroleum refinery operators.

Sources of Additional Information

For information on employment opportunities, contact State or local water pollution control agencies, State water and wastewater operator associations, State environmental training centers, or local offices of the State employment service.

For information on certification, contact:

☛ Association of Boards of Certification, 208 Fifth St., Ames, IA 50010-6259. Internet: <http://www.abccert.org>

For educational information related to a career as a water treatment plant operator, contact:

☛ American Water Works Association, 6666 West Quincy Ave., Denver, CO 80235.

☛ Water Environment Federation, 601 Wythe St., Alexandria, VA 22314.

Printing Occupations

Bindery Workers

(O*NET 89721, 92525, and 92546)

Significant Points

- Most bindery workers train on the job.
- Opportunities for hand bookbinders are limited because of the small number of establishments that do this highly specialized work.

- Employment of bindery workers is expected to grow more slowly than average, reflecting increasingly productive bindery operations.

Nature of the Work

The process of combining printed sheets into finished products such as books, magazines, catalogs, folders, directories, or product packaging is known as "binding." Binding involves cutting, folding, gathering, gluing, stapling, stitching, trimming, sewing, wrapping, and other finishing operations. Bindery workers operate and maintain the machines that perform these various tasks.